Title:
Research in Pediatric Residency: The Experience of Pediatric Chief Residents Nationally

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Keywords:
Medical Education, Research, Pediatrics, Chief Residents

Word Counts:
Abstract: 250
Manuscript: 1998
What's New: 40

Running Title:
Research in Pediatric Residency

Financial Disclosure Statement:
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Potential Conflicts of Interest:
The authors have no conflicts of interest relevant to this article to disclose.

This is the author's manuscript of the article published in final edited form as:
McHenry, M. S., Abramson, E. L., McKenna, M. P., & Li, S.-T. T. (2017). Research in Pediatric Residency: National Experience of Pediatric Chief Residents. Academic Pediatrics, 17(2), 144–148. https://doi.org/10.1016/j.acap.2016.09.010

Objective: To determine factors associated with increased research productivity, satisfaction, and perceived barriers to research within residency from the experience of pediatric chief residents.

Methods: An online cross-sectional survey was administered to 2014-2015 chief residents. Topics assessed included program demographics, career intentions, research productivity, satisfaction with research training and opportunities, and research barriers. Chi-square and Fisher's Exact Tests were used for descriptive statistics. Multivariable logistic regression analysis determined factors associated with productivity and research satisfaction.

Results: The response rate was 63% (165/261). Half (82/165) were productive in research. Most were satisfied with their quality of research training (55%; 90/165) and research opportunities (69%; 114/165). Chiefs reporting interest in research were five times more likely to be productive than those who did not (OR 5.2; 95% CI:2.3-11.8). Productive chiefs were more likely to report including research time in future careers (p=0.003). Most (83%; 137/165) thought their programs were supportive of resident research, but lack of time was frequently cited as a major barrier. Those satisfied with research opportunities were less likely to find lack of training (OR 0.3; 95% CI:0.1-0.7) or faculty mentorship (OR 0.2; 95% CI:0.0-0.9) as a major barrier.

Conclusions: Pediatric chief resident interest in research is strongly associated with research productivity during residency, and research productivity is strongly associated with career plans including research time. By cultivating research interest through faculty mentorship, research training, and dedicated time, pediatric residency programs may help foster early research success and, potentially lead to continued engagement with research in trainees' future careers.

What's New: Pediatric chief residents who were interested in research were five times more likely to be productive. Productivity was associated with incorporating research into career plans. Research training, faculty mentorship, and scholarly activity requirements were associated with satisfaction with research opportunities.

Child health research is critical for the advancement of pediatric medicine.[1, 2] We are facing a shortage of clinician-researchers.[3] To bridge this gap, we need to find ways to encourage early physicians to incorporate research in their future careers. Prior studies have shown that research experiences not only improve the ability to do research, but also positively influence decisions to be involved in research careers.[4-6] Pediatric residency is an ideal setting for exposure to research experiences. Scholarly activity during residency is an Accreditation Council for Graduate Medical Education (ACGME) requirement for all residents and residency programs are required to allocate adequate resources to facilitate resident involvement in scholarly activity.[7] There is limited literature looking at the implementation of research curriculums, tracks, and rotations to help support trainees with research. However, few data exist exploring the resident experience of research nationally.[8-11]

We performed a national survey of pediatric chief residents (CR) to understand their experiences with research during their residencies. Our specific aims were (1) to determine factors associated with increased research productivity (2) to determine factors associated with increased satisfaction with the quality of research training and research opportunities, and (3) to determine barriers to research faced during residency.

Methods:

Survey Administration

We performed a national cross-sectional web-based survey of pediatric CR. CR in ACGME-accredited pediatric residency programs were emailed an online survey link and recruitment

letter in February 2015, followed by two reminders. Three gift cards were randomly raffled off as incentives. The institutional review board at Indiana University approved this study.

Survey Content

The survey was adapted from a national assessment of pediatric residency program directors.[12] Both terms, "scholarly activity" and "research" were used in this survey. When asked if there was a scholarly activity requirement in their programs, respondents were asked to define what qualified as scholarly activity. In all other instances, the words were interchangeable, and thus we only use the term "research" throughout the remainder of the manuscript. Topics assessed included program size (small (≤30), medium (31-60), large (>60)), program location (Northeast, Midwest, South, West), career intentions, research participation, productivity (publication or presentation at national meeting), satisfaction with research training and opportunities, and barriers to research. We confirmed program-related characteristics, such as size and location, using FREIDA (the American Medical Association's online residency and fellowship database).

Measures

Research productivity was defined as manuscript publication or abstract presentation at a national conference, including those accepted but not yet published or presented. We used a 7-point Likert scale to evaluate satisfaction and interest, with "1" indicating not at all satisfied/interested, "4" indicating somewhat satisfied/interested, and "7" indicating completely satisfied/interested. We defined "satisfied" and "interested" as a 5, 6, or 7 on the scale.

Analysis

We analyzed program demographics using standard summary statistics. Only one respondent per program was included in the program demographics analysis. We used chi-square testing and

Fisher's Exact Test to evaluate association between categorical variables. We used multivariable logistic regression adjusting for program size and region to determine factors associated with productivity and satisfaction with research opportunities and training. Factors that were evaluated and controlled for in the model included research time in residency (<8 weeks and ≥8 weeks), research interest, scholarly activities requirement, perceived barriers related to lack of research training, mentorship, and funding to conduct research. We summarized results using odds ratios (OR) and 95% confidence intervals (CI). Analyses were performed using IBM SPSS Version 23.0.

Results:

Response Rate:

A total of 165 CR completed the survey, representing 70% (139/199) of all ACGME-accredited pediatric programs. Three programs did not have CR and eight did not have accurate contact information publically available. Twenty-two programs had two CR complete the survey and two had three CR complete the survey. Some CR had a group email. The response rate per email address contacted was 63% (165/261).

Participant and Program Demographics

Respondents were representative of all CR in terms of program size and location (Table 1). The vast majority (98%, n=162) completed their residency training at the same program where they were currently CR. Nearly a third (31%, n=51) believed they were equally interested in research

compared to their co-residents, while just over a third (39%, n=65) felt they were more interested. Eight percent (n=13) were part of a special research track during residency. Most (84%, n=140) reported that scholarly activity was a program requirement.

Half (51%, n=84) intended on pursing a fellowship, and 61% (n=101) intended on pursuing an academic medicine career. Eighty-five percent (n=140) expected to devote some time to research, and nearly a third (32.9%, n=54) expected to devote 25% or more time to research.

Research Productivity

Half (50%, n=82) of CR reported productivity in research activities. Table 2 shows that productive CR were more likely to be interested in research (OR 5.19 (95%CI: 2.29-11.75)). Multivariate logistic regression found no other significant differences between productive and non-productive CR. Productive CR were significantly more likely to report career plans to commit 25% or more time towards research (p=0.003)

Satisfaction with Research Opportunities and Training

Over half (55%, n=90) of CR were satisfied with the quality of research training in their residency. Our multivariable logistic regression found no significant differences between those who were satisfied compared to those who were not (data not shown).

Two-thirds (69%, n=113) of CR were satisfied with the research opportunities provided by their programs. Table 3 shows that CR who were satisfied with their research opportunities were more likely to have a scholarly activity requirement (OR 3.71 (95% CI:1.32-10.42)) and less

likely to identify lack of research training (OR 0.28 (95% CI: 0.11-0.70) and lack of faculty mentorship (OR 0.17 (95% CI:0.03-0.98) as major barriers.

The majority (83%, n=137) of CR thought their programs were more than somewhat supportive of resident research, with 38% (n=63) saying their programs were extremely supportive.

Barriers

Approximately half (47%, n=77) of all CR reported that lack of time was a major barrier to research. Of those who reported time as a major barrier, there was no difference between those who spent more or less than 8 weeks doing research during residency (p=0.085). A quarter (27%, n=44) stated that lack of research training was a major barrier. Table 4 shows that regardless of program size, lack of time and lack of training to conduct research were identified as the top two major barriers. Additionally, lack of funding to conduct research was more likely to be seen as a major barrier in medium-sized programs.

Discussion

We found half of pediatric CR published or presented their research nationally. CR productivity was strongly associated with CR interest in research. CR interest in devoting ≥25% of their future academic career in research was strongly associated with research productivity during residency. In addition, CR satisfaction with research opportunities was associated with faculty research mentorship and research training during residency, as well as having a scholarly activity

requirement. CR felt that the largest barrier to research was lack of time, even in those with >8 weeks protected time.

We found that CR research productivity was strongly associated with CR interest in research and interest in devoting ≥25% of future career in research. These findings are consistent with prior literature that found medical students who were strongly interested in research at the time of their graduation were more likely to pursue a career as clinician-scientists.[13] These findings suggest that supporting resident research interests such that they are more likely to be productive in research may improve the chances that they would incorporate research into their future careers.

Our findings that CR satisfaction with research opportunities was associated with faculty research mentorship and research training during residency suggest that pediatric programs that are able to provide research mentorship and training experiences will better support residents interested in research. These findings are supported by a recent study which found that residents who completed a clinical outcomes research pathway were more productive in their scholarly activity than non-participants.[6] With the advent of individualized curricula in pediatric residency, programs have the opportunity to help residents tailor their experiences to their individual interests. We strongly recommend this should include providing faculty mentorship and research training for those residents interested in research, which allows these trainees opportunities and support to develop careers as clinician-scientists.

Our finding that 69% of CR were satisfied with research opportunities in their program is similar to that reported in the 2015 ACGME Resident Survey.[14] While this is an overall positive finding, it is clear that barriers to research impact satisfaction with research opportunities. In our study, lack of time and research training were consistently cited as major barriers, and lack of faculty mentorship and research training were the only barriers associated with satisfaction. This

is consistent with findings from other studies.[12, 15, 16] As pediatric departments consider ways to increase research productivity within their residency programs, attention should be given to cultivating and recruiting faculty that can mentor and educate residents in various aspects of research. Having a core curriculum and carving out protected time, such as through use of individualized curriculum, are also likely to foster interest in and satisfaction with the research experience during residency. This may, in turn, lead to productivity and set the stage for greater interest in pursuing research in the future, as productive CRs in our study were more likely to report wanting ≥25% research time in their career plans.

While lack of funding was another identified barrier, it did not impact productivity or satisfaction. However, we were surprised to find that it was identified as a major barrier significantly more in medium-sized programs (31-60 residents) than small or large programs. Differences between pediatric program sizes have been seen with research training and career intentions, but little is known about how funding may differ between programs.[17] However, it could be postulated that small programs have fewer residents, thus they may more easily support those interested in research. Alternatively, large programs may have access to more resources and funding due to the institutional size, which helps to support their programs. Further evaluation of this finding should be considered.

Our study has several limitations. Despite our high response rate and program representation, we did not have a complete and accurate resource to determine the total number of pediatric CR across accredited program. We also did not collect more in-depth information regarding programs, such as the number of faculty and external grant funding that may have influenced research quality or productivity. Ten of the 11 programs for which we were unable to get CR contact information were small in size and may have reported different barriers and facilitators of

research productivity. However, regardless of program size, CR identified similar barriers to research. Because this is a research-focused survey, it is possible that the estimates of research interest and productivity may be overestimated as a result of response bias. Additionally, we may not have had sufficient power to delineate differences among the CR, as suggested by our large confidence intervals. With our focus on pediatric CR, our findings may not be generalizable to all pediatric residents or residents from other specialty programs. In general, CR may be more motivated to publish and participate in research than their peers. However, our study had similar proportions of CR interested in fellowships and academic medicine as other pediatric residents in the recent literature.[17] As this was a survey study, we cannot infer causation, merely associations.

Conclusions:

Interest in research was the only variable found to be associated with productivity, and having adequate faculty mentorship, research training, and a scholarly activity requirement were the variables associated with satisfaction with research opportunities. In addition, productive CR were more likely to want to include research in >25% of their future career plans. In light of these findings, when considering ways of increasing resident research productivity, pediatric departments should consider supporting their faculty in research and research education of residents, to create curriculum and environments that enable interested residents to have increased chance of being productive in their research pursuits and encourage their development as clinician-scientists.

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Table 1: Program demographics of respondents

Variable	Total Respondents* N (%) N = 137	All ACGME-accredited pediatric residency programs N (%) N = 199	P value
Program Size			0.49
Small (≤30 residents)	41 (29.9)	72 (36.2)	
Medium (31-60 residents)	60 (43.7)	80 (40.2)	
Large (>60 residents)	36 (26.3)	47 (23.6)	
Program Location			0.89
Northeast (ME,NH, MA, CT, VT, RI, PA, NY, NJ)	38 (27.7)	58 (29.1)	
Midwest (WI, MI, IL, IN, OH, MO, ND, SD, NE, MN, IA)	36 (26.3)	45 (22.6)	
South (TX, OK, LA, AR, MS, AL, TN, KY, WV, VA, NC, SC, GA, FL MD, DE, DC, PR)	46 (33.6)	69 (34.7)	
West (ID, MT, UT, AZ, WY, CO, NM, CA, NV, OR, WA, HI, AK)	17 (12.4)	27 (13.6)	

*- Only one respondent per program was included in program demographics analysis.

Table 2: Factors Associated with Chief Resident Research Productivity

Variable	Odds Ratio (95% Confidence Interval)
PROGRAM SIZE	
Small (≤ 30 residents)	Referent
Medium (31-60 residents)	1.12 (0.45-2.80)
Large (>60 residents)	0.73 (0.27-2.03)
PROGRAM REGION	
Northeast	Referent
South	0.72 (0.28-1.87)
West	0.75 (0.21-2.65)
Midwest	0.52 (0.19-1.43)
VARIABLES	
Requirement to do scholarly activity	1.26 (0.47-3.38)
Identifies as being interested in research	**5.19 (2.29-11.75)**
Identifies lack of training as a major barrier	1.31 (0.55-3.13)
Identifies lack of faculty mentorship as a major barrier	0.57 (0.11-2.94)
Identifies lack of funding to conduct research as a major barrier	0.88 (0.25-3.15)
Spent 8 weeks or more doing research in residency	1.69 (0.78-3.62)

Table 3: Factors Associated with Chief Resident Satisfaction with Research Opportunities

Variable	Odds Ratio (95% CI)
PROGRAM SIZE	
Small (≤ 30 residents)	Referent
Medium (31-60 residents)	2.23 (0.79-6.26)
Large (>60 residents)	1.78 (0.59-5.43)
PROGRAM REGION	
Northeast	Referent
South	1.70 (0.60-4.86)
West	0.65 (0.17-2.40)
Midwest	3.15 (0.96-10.32)
VARIABLES	
Requirement to do scholarly activity	**3.71 (1.32-10.42)**
Identifies as being interested in research	0.97 (0.40-2.35)
Identifies lack of training as a major barrier	**0.28 (0.11-0.70)**
Identifies lack of faculty mentorship as a major barrier	**0.17 (0.03-0.98)**
Identifies lack of funding to conduct research as a major barrier	1.97 (0.49-7.94)
Spent 8 weeks or more doing research in residency	0.45 (0.19-1.03)

Table 4: Major Barriers to Research for Chief Residents by Program Size

Areas Identified as Major Barriers	Small N (%) N =49	Medium N (%) N =69	Large N (%) N =47	P value
Time to participate in research	24 (49.0)	32 (46.4)	21 (44.7)	0.28
Training to conduct a research	15 (30.6)	19 (27.5)	10 (21.3)	0.25
Research curriculum	12(24.5)	14 (20.3)	7 (14.9)	0.31
Statistical support	5 (10.2)	10 (14.5)	5 (10.6)	0.29
Funding to conduct research	4 (8.2)	15 (21.7)	4 (8.5)	**0.005**
Faculty mentorship to conduct research	4 (8.2)	6 (8.7)	1 (2.1)	0.18
Funding to present research	1 (2.0)	5 (7.3)	3 (6.4)	0.26
Program director/chair support	4 (8.2)	3 (4.4)	0 (0)	0.71